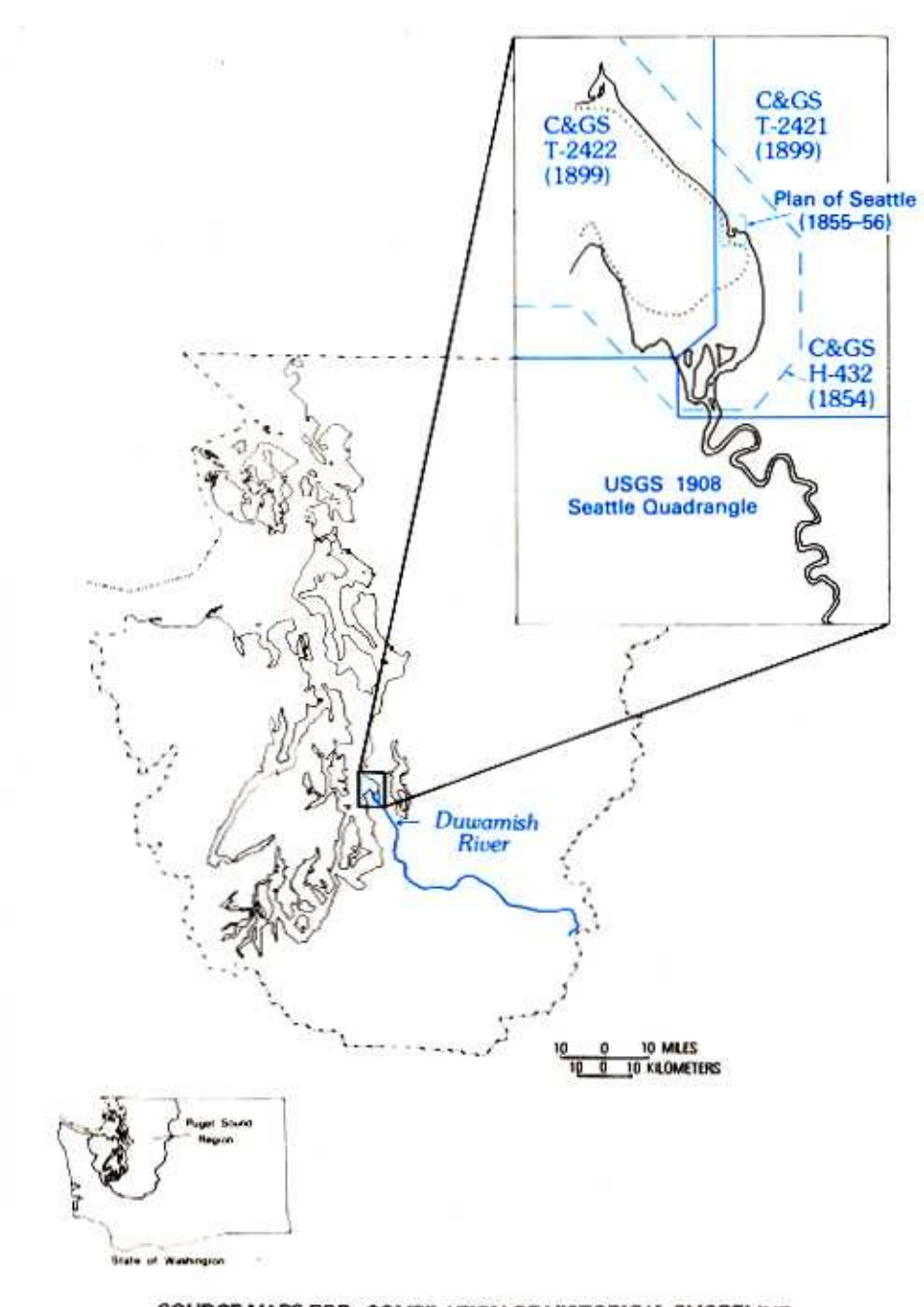


Summary of Environmental Changes and Some Planning Considerations	
Progradation (seaward advance of shoreline)	None apparent by natural processes. Bayward growth has been substantial, but is largely, if not entirely, due to manmade landfills.
Regression (landward retreat of shoreline)	None.
Channel migration	None apparent by natural processes.
Channel straightening	Substantial. About 15 km of the former river channel has been filled and replaced by a channel 7 km in length to create the Waterway.
Diking or substantial filling of subaerial delta land near salt-water shoreline	The shoreline of the present-day subaerial part of the delta is landfilled protected by bulkheads and riprap.
Diking or substantial filling near stream banks	Continuous dikes and bulkheads, extending upstream beyond the map area, confine the Duwamish River channel on both sides.
Other artificial landfill on subaerial delta land	Landfill has been extensive for commercial, industrial, and port facilities. Landfills cover all former islands between distributary stream channels and former marsh embayments around Elliott Bay.
Nearlly on subaerial delta land	Landfill has been placed on the inter-tidal area for commercial, industrial, and port facilities. Approximately 10 sq km of additional land—indicated by seaward of mean lower low-water line—has been created mainly by deposition of dredge spoil and by hydraulic siltation from Beacon Hill and other nearby areas.
Loss of subaerial wetland	About 0.03 sq km of subaerial marsh remain from 2.6 sq km mapped in 1899 (table 2). This does not include an additional but unknown amount of marshland that existed in the Duwamish Valley upstream beyond the extent of 1899 mapping.
Loss of intertidal wetland	About 8.5 sq km of intertidal wetland has been eliminated mostly by hydraulic filling since the early mapping.
Some planning considerations	The former subaerial and intertidal wetland has been lost from the Duwamish delta. Changing land uses have been associated with a decrease in water quality of Duwamish River. At present, pollution-control measures are in effect; the greatest potential for water-quality degradation in the delta area probably is related to industrial activities, including shipping (Williams and others, 1975). Channel straightening, bulkheads, and dikes undoubtedly have reduced the frequency of flooding in upstream; however, the lower reaches of the waterway are susceptible to occasional coastal flooding, such as occurred in December 1977. Ground instability on unconsolidated landfill deposits can be a potential problem, particularly during an earthquake. For example, ground principally on hydraulic fill subsided in the industrial area along the Duwamish River during the 1949 and 1966 earthquakes, apparently as a result of liquefaction during ground shaking (U.S. Geological Survey, 1975, p. 95, 96).



SOURCE MAPS FOR COMPILATION OF HISTORICAL SHORELINE  
AND LOCATION OF RIVER-MOUTH DELTA

**HISTORICAL CHANGES OF SHORELINE AND WETLAND AT DUWAMISH RIVER AND ELLIOTT BAY, WASHINGTON**  
By  
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